# epiTRENDS

A Monthly Bulletin on Communicable Disease Epidemiology and Public Health Practice in Washington State


## Rabies Prevention


**Vol. 16 No. 4**

04.11


Rabies is a viral infection of the central nervous system which is almost always fatal. Infected animals, typically bats or carnivores, transmit the virus. Suspected human exposure to rabies is notifiable in Washington State.

**"Man Bitten by Mad Dog"**
**Illustration detail from an Arabic translation of the *Materia Medica* by Dioscorides, Iraq, Baghdad, dated 1224**



### Discussion Points

Here are four discussion points related to rabies prevention. The answers are contained in the text, or refer to the answers at the end of the article.

1. True or false. Because raccoon rabies has not been found on the west coast, it is not possible for Washington State raccoons to get rabies.
2. What is the new Washington State reporting requirement for animal bites?
3. If a cat bites a person, is the incubation period or contagious period for rabies of more concern when assessing the risk to the person?
4. If a dog becomes ill during a 10-day observation period, is it appropriate to see if the dog survives the full ten days before taking any action?


*Continued page 2*



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## History and Epidemiology

Big Brown bat, *Eptesicus fuscus*

Photo courtesy of Matt Reinbold
Wikimedia Commons

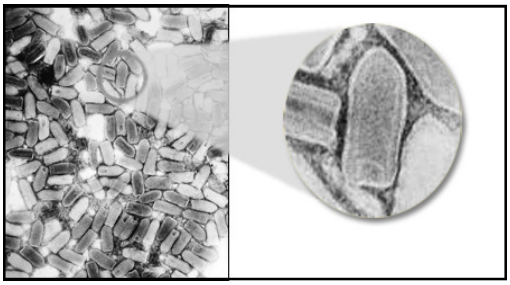
Rabies was first described roughly 4000 years ago and the link between human disease and animal disease was readily recognized. Accurate clinical descriptions date back to the 1500s.

Classic rabies virus is one of several species within the genus *Lyssavirus* that are neurotropic, affecting the central nervous system and causing fatal encephalitis. Rabies occurs worldwide and can infect any mammal though "variants" or strains of rabies virus are highly associated with certain reservoir species (e.g., raccoon, skunk, silver-haired bat, and big brown bat), which differ by geographic region. Bats are the primary reservoir in Washington, Oregon, and Idaho. Elsewhere, skunks, raccoons, foxes, as well as bats are reservoirs. However, species-specific variants can infect other mammal species. For example, although the raccoon variant of rabies virus has not come to Washington State, a raccoon may become infected with a bat variant and develop rabies.

Since the 1940s, the epidemiology of rabies in the United States has changed. The source of human disease has shifted from domesticated animals to wildlife, principally bats, raccoons, skunks, and foxes. Vaccination has eliminated dog variant rabies in the United States, and as a result, human rabies deaths have declined from over 100 per year to only one or two per year. Currently, bats are the most common source of human exposure in the United States, but in many countries dogs as well as other carnivores such as coyotes and hyenas are reservoirs.

## The Disease

After rabies virus enters the body, typically through a bite, it travels through peripheral nerves to the brain. The incubation period (time from exposure until symptoms begin) depends on the rabies virus variant, susceptibility of the species exposed, proximity of the virus to the nervous system, amount of virus introduced, and post-exposure wound management. Incubation periods are usually weeks to months.



Characteristic bullet-shape of rhabdoviruses, including rabies

Photo courtesy of CDC

*Continued page 3*

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During incubation, an animal cannot transmit rabies. Once the virus has multiplied in the brain it is passed to the salivary glands then saliva. The contagious period begins when an animal can transmit rabies through its saliva. From this point, the disease progresses rapidly and an infected animal shows signs of disease (e.g., agitation, unusual behavior, gait changes) and will quickly die. Studies of domestic dogs, cats, and ferrets have determined that death occurs within ten days of onset; this is the basis for the 10-day observation period in these species. For other species, including hybrids (e.g., wolf-dog or cat-wild cat crossbreeds), the contagious period is unknown so an observation period is not applicable.

Face of rabid dog

Photo courtesy of CDC
Barbara Andrews

In humans, incubation is usually 3-8 weeks but can range from a few days to several years. Symptoms include fever, seizures, hypersalivation, hydrophobia, agitation, paralysis, and rapidly progressing encephalitis. Excluding three known survivors and one recent report of presumptive aborted rabies, rabies is fatal once signs develop. Person-to-person rabies transmission has occurred through corneal and organ transplantation; transmission through bites or other mucous membrane exposure is theoretically possible.

## Rabies Prevention

Preventing rabies is essential. In this state, local law currently mandates vaccination of dogs, cats, and ferrets. Washington Administrative Code revisions will require vaccination of these animals beginning in 2012 but compliance may be difficult to enforce, particularly as people transport animals across state and international borders.

Appropriate prophylaxis can prevent human rabies.

Image courtesy of CDC

Appropriate prophylaxis before a bite/exposure (pre-exposure) or after a bite/exposure (post-exposure) can prevent human infections. Persons in high risk activities involving potentially rabid animals should receive pre-exposure immunization consisting of three vaccine doses. Those at particular risk, such as researchers working with rabies virus, should have antibody to rabies virus measured periodically using the Rapid Fluorescent Focus Inhibition Test (RFFIT).

*Continued page 4*

Post-exposure prophylaxis (PEP) includes human rabies immune globulin (HRIG) for passive immunity and four doses of vaccine. However, a person who is immunosuppressed requires a fifth dose of vaccine and should have antibody titers checked using the RFFIT (not ELISA) to document an appropriate immune response. A person who already had a three-dose vaccination series only requires two boosters of vaccine without HRIG for PEP.

Effective February 2011, only bites/exposures in which human exposure to rabies is suspected are reportable to local health jurisdictions (LHJs). Reporting includes:

- "Rabies, suspected human exposure (due to a bite from or other exposure to an animal that is suspected of being infected with rabies)," and
- "Animal bites (when human exposure to rabies is suspected)."

## Risk Assessment

Determining the need for PEP begins with assessing exposure. A bite exposure is any penetration of the skin by teeth, regardless of location or minor nature of injury. A non-bite exposure is contamination of wounds, abrasions, or mucous membranes with saliva or other potentially infectious material (such as neural tissue) from a rabid animal. A bat in a room with a sleeping or intoxicated person, child/infant, mentally handicapped person, or anyone who is unable to give a reliable history might be considered an exposure. Contact with fur (e.g., petting an animal), blood, urine, other fluids (e.g., skunk spray), or feces of a rabid animal is not an exposure. If exposure occurred, evaluating the risk of rabies includes whether the animal species is a rabies reservoir, if it had symptoms suggestive of rabies, whether the bite was provoked or unprovoked, the epidemiology of rabies in the geographic location of exposure, the animal vaccination status, and the likelihood that the animal was exposed to another rabid animal (e.g., indoor vs. outdoor animal, pet vs. stray).

Healthy dogs, cats, and ferrets can be observed for ten days from the time the human was exposed. Any illness in the dog/cat/ferret during the ten days should be evaluated by a veterinarian for signs of rabies. If the veterinarian suspects rabies, the animal should be immediately euthanized and tested promptly.

PEP should be given when an animal has tested positive for rabies. Additionally, when testing is not possible or results are unsatisfactory, PEP should be given for the following: a bat exposure or when a person is unable to state that contact with a bat did not occur, exposure to a rabid-acting mammal, or exposure to a carnivore from a rabies endemic area.

Several resources have been developed to help guide exposure assessments, including:

- "Guidance for Human Rabies Prevention" algorithm (http://www.doh.wa.gov/notify/other/rabiesalg.pdf): designed to help clinicians and veterinarians determine what should be reported to the LHJ
- "Dear provider" letter (available from DOH): explains the animal bite reporting change to providers

*Continued page 5*

- "Dear patient" letter (available from DOH): explains the 10-day observation period to dog, cat, and ferret bite victims; intended for providers or LHJs to give bite victims
- Suspected Rabies Exposure Surveillance and Response Guideline (http://www.doh.wa.gov/notify/guidelines/pdf/rabiesexp.pdf): for LHJ use in case investigation and exposure assessment.

Rabies is an essentially fatal illness but it can be effectively prevented. Public health agencies can assist health care providers in assuring that exposed patients receive optimum rabies prevention care and advice.

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## Answers to Public Health Discussion Points

1. False. Although unlikely, raccoons can be infected with other rabies virus variants such as one of the bat variants. Thus, the risk of rabies transmission cannot be determined by the species of the biting animal alone. Symptoms of rabies in a biting animal and/or a truly unprovoked bite should make a healthcare provider suspect a human rabies exposure.

2. Effective February 5, 2011, only bites in which human exposure to rabies is suspected need to be reported. Any other human exposure to rabies, e.g., scratch or contamination of mucous membrane with saliva or nervous tissue from a rabid or suspected rabid animal, should also be reported to local health.

3. When a cat bites a person, we consider whether the cat was rabid at the time of the bite. A 10-day observation period is based on the known **contagious period** for cats (as well as dogs and ferrets). Once a cat, dog, or ferret becomes rabid and is shedding rabies virus in its saliva, it will die within ten days.

   If a cat is exposed to a rabid bat, then it is important to think about the **incubation period**, which can be up to six months. In this case, an unvaccinated cat should be kept in strict isolation for six months to see if rabies develops and vaccinated either at the beginning or one month prior to the end the six month isolation; otherwise the cat should be euthanized.

4. No. Any illness in a dog (or cat or ferret) undergoing a 10-day observation should be immediately reported to the local health jurisdiction and the animal should be evaluated by a veterinarian for signs of rabies. If the veterinarian determines the illness is consistent with rabies, then the animal should be immediately euthanized and tested for rabies. Delaying the veterinary examination could mean prolonging the time before post-exposure prophylaxis is started for the exposed human.

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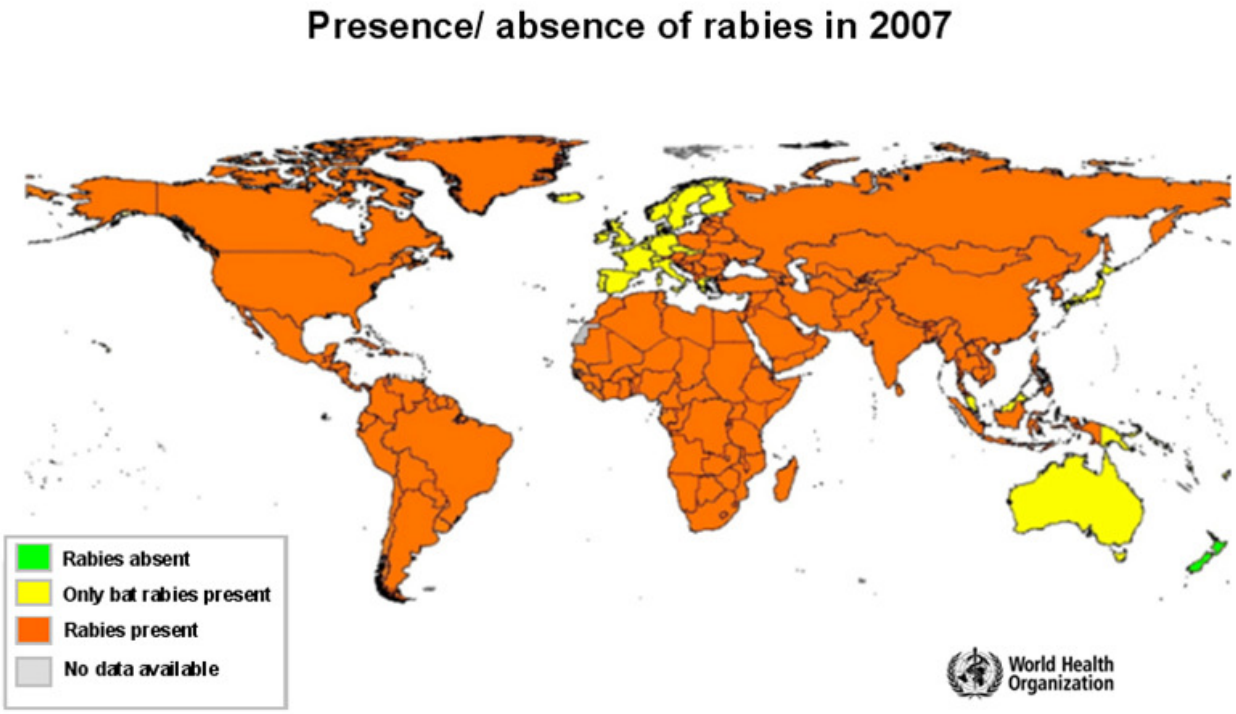


Map courtesy of WHO

## Further Reading

1. http://www.cdc.gov/mmwr/PDF/rr/rr5703.pdf — Human Rabies Prevention / ACIP recommendations (2008)
2. http://www.cdc.gov/mmwr/pdf/rr/rr5902.pdf — 4 dose vaccine schedule for PEP (2010)
3. http://www.cdc.gov/mmwr/PDF/rr/rr5702.pdf — Compendium of animal rabies prevention/ control (2008)
4. http://www.cdc.gov/mmwr/pdf/wk/mm6014.pdf — Human Rabies—Michigan, 2009

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